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# An Analysis of Conditional Responses in Dialogue\*

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**Abstract.** We analyze naturally occurring collaborative responses of the form “Not (if) *c*/Yes if *c*”. We distinguish two cases: when *c* is established in the context, the conditional response indicates a possible need to revise *c*, and thus opens negotiation; otherwise, the conditional response raises the question whether *c*. We discuss the contexts where such responses are used and the dialogue acts they realize. We propose a uniform approach to their generation and interpretation.

## 1 Introduction

The goal of this paper is to provide a basic account of *conditional responses* (CRs) in collaborative dialogues in terms of their appropriateness conditions and the dialogue moves they perform. This work originates from our interest in collaborative turns in task-oriented dialogue; for example, responses which contain more than just the response particles *yes*, *no* or *ok*. As instances of such collaborative responses we encountered the CRs in (1:9) and (2:4), where the positive or negative polarity of the response is *contingent* upon some *attribute value* (A/V). In addition, a CR seems to suggest that for another A/V the response would have the opposite polarity. Consider (1).<sup>1</sup>

- (1) 1.A: uh, let’s see what would get you there then leaving probabl- the seventh. from San Jose or San Francisco?  
2.C San Francisco. actually Oakland would be good too on that  
3.A: I don’t know if there are any red eyes from there let’s see  
4.C: ok  
5.A: there is one on United that leaves Oakland at eleven thirty p.m. and arrives Chicago five twenty five a.m.  
6.C: so that’s a two hour hold there  
7.A: yes  
8.C: waiting for that flight ok any others?  
9.A: uh not from Oakland.  
10.A: departing from San Francisco it’s about the same

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<sup>1</sup> We looked at the Verbmobil appointment-scheduling corpus [1] and the SRI’s American Express travel agency data [2]. The examples in this paper are from [2]. A and C mean “agent” and “customer”, respectively.

(1:9) gives a negative CR to the question (1:8); there are no other flights from Oakland. This answer is contingent on the A/V of departing from Oakland, and leaves open, or even seems to suggest, the possibility of a flight from another departure city, namely the previously mentioned San Francisco. This possibility is addressed and refuted in (1:10).

(2:4) gives a positive CR as a confirmation of the assertion (2:3). But this CR is contingent on the A/V “rate”: only if the going rate is higher, the customer has to pay both a penalty and the going rate. The CR implies that for the same or lower rate, the customer only has to pay the penalty. (2:5) re-confirms that the rate is going to be higher.

- (2) 1.C: there’s a hundred dollar fine  
 2.A: okay  
 3.C: and p- penalty plus ahh we pay for the going rate  
 4.A: yeah if ther- if it’s going to be a higher rate  
 5.C: it’s going to be a higher rate, ok now [...]

Following on our proposal in [3], we consider the suggestion implicit in (1:9) and (2:4) that for another A/V the response would have the opposite polarity, as an *implicature* rather than part of the assertion, since it is cancellable (cf. (1:10)). The assertions and implicatures corresponding to CRs are summarized in Figure 1. The utterance to which the CR replies may be either a yes/no question (whether  $q$  holds) as in (1:8), or an assertion proposing  $q$  for acceptance or rejection, like (2:3). In the approach to dialogue modelling we are using,  $q$  is represented as the current *question under discussion* (QUD, [4]).

<i>QUD</i>	$q$	$q$
<i>Response</i>	Not (if) $c$	Yes if $c$
<i>Assertion</i>	If $c$ , not- $q$	If $c$ , then $q$
<i>Implicature</i>	Possibly, if not- $c$ , then $q$	Possibly, if not- $c$ , then not- $q$

**Fig. 1.** Patterns of conditional responses

Even though CRs are not very frequent in the two corpora we studied, they are efficient means for collaboration, which enable to hint at alternatives in solving a task. Our goal therefore is to provide the basis for understanding and generation of CRs in a dialogue system designed to handle collaborative dialogues in the travel domain.

**Overview.** The rest of the paper is organized as follows. In §2 we discuss the interpretation and appropriateness conditions of CRs. In §3 we discuss the dialogue moves corresponding to CRs. We end the paper with conclusions, where we briefly address issues of future interest.

## 2 Uses of conditional responses

[5] characterize CRs in terms of the speaker’s motivation to provide information “about conditions that could affect the veracity of the response”. However, they only consider

cases like (2) in which the A/V on which the CR is contingent has not yet been determined in the preceding context. Cases like (1) are left unnoticed. In the present section we briefly address the two cases we distinguish. The distinction turns out to be important for the *dialogue move* that such responses perform (cf. §3).

*CR with not-determined A/V (NDCR).* A CR can be contingent on an A/V  $c$  which has not yet been determined in the preceding context, as in (2).

The interpretation of an NDCR as a response to a QUD  $q$  is that (i) it is still not determined whether  $q$ , because (ii) the answer is contingent on  $c$  (Figure 1), and thus (iii) the question whether  $c$  holds is implicitly raised. Consider (2:4) which raises the question whether “higher rate” holds. This question is resolved in the next turn (2:5).

From the production point of view, we observe that it is appropriate to produce NDCR when (i) responding to a QUD  $q$ , where (ii) the response is either  $q$  or *not- $q$* , depending on some additional A/V  $c$  which has not yet been established in the context.

*CR with contextually-determined A/V (CDCR).* Another context in which a CR is appropriate is when a response to a QUD  $q$  is contingent on an A/V  $c$  that has already been established in the preceding context, as in (1).

The interpretation of a CDCR is that (i) it is determined whether  $q$  or *not- $q$*  holds, because (ii) the answer (specified in Figure 1) is contingent on  $c$  and  $c$  is established. Moreover, (iii) the CDCR indicates the reason for the answer. There is an additional aspect of a CDCR which distinguishes it from NDCR. Namely, by reminding of the A/V on which the response is contingent, a CDCR (iv) proposes to reconsider the earlier made decision by implicitly re-raising the question whether  $c$  should hold. Thus, a negotiation phase is opened in which either the conflicting A/V is revised, or is confirmed. In the latter case a different solution to the overall goal needs to be sought.

Re-raising  $c$  differs from raising a “new” question at least in two aspects:  $c$  must be *negotiable*, and the re-raised  $c$  requires not only a positive or negative reply but also some kind of acknowledgment whether or not the A/V is to be revised (and how).

From the production point of view, we observe that it is appropriate to produce a CDCR when (i) responding to a QUD  $q$ , where (ii) the response is either  $q$  or *not- $q$* , depending on an A/V  $c$  which has been established in the preceding context and is negotiable.

For both NDCR and CDCR, the choice between a positive or a negative one depends on which one is more cooperative in the context. This in turn depends on what the preferred answer to the question whether  $q$  is assumed to be.

### 3 Conditional response dialogue moves

As we have seen, the two different kinds of CRs provide a response contingent on an A/V where a CDCR makes a proposal for revising the contextually determined A/V (1:9), and a NDCR raises the question whether the A/V holds (2:4). This suggests that CDCR and NDCR perform different dialogue moves. We now briefly consider how CRs could be characterized in terms of the DAMSL standard for dialogue annotation [6].

*Forward looking function.* We assign CDCRs the forward looking function of *open option*, and NDCRs the one of *info-request* (although the other participant is not always obliged to provide an answer to it, as we argue in [3]).

*Backward looking function.* We assign CRs multiple backward looking functions. Both CDCRs and NDCRs are assigned the function *answer* (if preceded by a question) or *non-answer* otherwise. In addition, CDCRs are assigned the function *partial reject/accept* (depending on polarity), and NDCRs the function *hold*.

## 4 Conclusions

In this paper we proposed an analysis of *conditional responses*, which arise naturally in dialogues allowing for mixed initiative and negotiation. We proposed two types of conditional responses: One type describes the case where the answer is contingent on an A/V that has not yet been determined in the context (NDCRs). The other type deals with an A/V that has already been set in the context, and which now needs to be reconsidered (CDCRs). The distinction properly clarifies the different effects on dialogue context conditional responses may have. We also tried to characterize the differences in the dialogue moves performed by CDCRs and NDCRs.

We are developing an implementation of CRs in the GoDiS system [7]. GoDiS is an experimental system based on the information-state update approach to dialogue as proposed in the TRINDI and SIRIDUS projects [8], [9]. It was initially designed to handle information-seeking dialogues in the travel domain.

The distinction of two types of CDCRs seems relevant for the appropriate prosodic realization of this kind of responses in English. For example, NDCR is appropriate with a neutral prosodic pattern, whereas the CDCR seems to require prosodically marked contrast. We plan to investigate the prosodic properties of CRs with respect to context. Another future objective is to investigate how various other surface form realizations of CRs we found in the corpora, such as *only (if)*, *but only (if)*, *unless*, relate to each other and how they fit the pattern in Figure 1.

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